Rest-Breaking Alternatives for Sweet Cherry and an Update on Chill Accumulation

Kitren Glozer, Dept. of Plant Sciences, UC Davis

Many cherry growers have had mixed results in their use of rest-breaking chemicals (RBs). Results that have varied from year-to-year include: amount of bloom advance and maturity advance, %fruit set and phytotoxicity (bud death). Some of the variation can be due to cherry variety and rootstock, location, type of RB, surfactant, and the concentration and method of application (i.e. carrier volume used per acre). Production practices like nutrition, pruning and irrigation may also add to variation.

A significant contributor to response variation is the amount and distribution of chilling accumulated in any given year. Chill accumulation can be calculated using various mathematical models, the simplest of which is the 'chill hours' model. Chill hours (**CH**) = the number of hours equal to or less than 45°F accumulated over the dormant season, which has traditionally started on November 1. Not all 'chill', however, is effective, and this is one problem with the 'chill hour' model. When **CH** alternate with temperatures above 45°F, such as is common in California's fall and winter, a canceling effect can occur for some of that 'chill' and there is no way to measure this cancellation with the 'chill hour' model.

Since 2002, researchers with UC Davis and UC Cooperative Extension (Southwick, Glozer and Grant), have tested the Dynamic Model as a way of calculating chill accumulation, with the support of the California Cherry Advisory Board and the cooperation of many growers. This model was developed in Israel in the 1980-1990's, where temperatures are also mild and variable in the dormant season. The model calculates chilling accumulation as 'chill portions' (**CP)**, using a range of temperatures from ~35-55°F (some temperatures are more effective than others), and also accounts for chill cancellation by fluctuating warm temperatures. Since we have used this model in field trials and in re-evaluating historic data from our trials that began in 1994, we have been able to explain some of the variation in response. We found that **CH** vary much more widely from place-to-place in any single year and also from year-to-year than do **CP**. We also found that we have had the best response within a certain range of **CP** accumulated at application of RBs. Initially we recommended application of Dormex when ~70% of chill hours had been satisfied (550-600 **CH**), and application of CAN17 at 650-750 **CH**. This can be a problem in years and locations where chill hour accumulation does not reach this minimum requirement (very poor chill years), and also does not account for wide variation in **CH** from place-to-place. In 2004 we modified this recommendation to 44-52 **CP** for Dormex, and 48-56 **CP** for CAN17. These recommendations were based on trials for 'Bing' and do not represent any other cultivar's requirements for chill accumulation or application of RBs.

Defining the use of **CP** for timing RB applications is a work in progress. In the 2004-2005 research trial conducted by Glozer and Grant, we found that chill accumulation began well before November 1 so that ~60-80 **CH** or 4-8 **CP** had already accumulated by that date, depending on location. We made our applications of RBs using the guideline recommendations previously established and the November 1 'start date' (Dormex applied @ 42-50 **CP**; CAN17 @ 42-53 **CP**). We found that a high percentage of bud death resulted from the last Dormex treatment and concluded that this treatment was too late. Good bloom advance, fruit set and fruit maturity advance were found with the earliest treatments. If we use the Dynamic Model to time the 'start' of the dormant season chill accumulation instead of November 1 calendar date, we have to adjust the chill portion accumulation accordingly so that Dormex was applied @ 49-57 **CP** and CAN17 @ 49-60 **CP**, using a data logger at the trial orchard.

When we review some of the recent years and locations where we have conducted our trials, we have found that chill accumulation before November 1 is not uncommon (Table 1). In some years, few **CP** have accumulated before November 1 and a difference of 2-3 **CP** may not have much effect on RB application timing. However, a difference of 6-8 **CP** may mean the difference between success and failure (reduction of fruit set, bud death). In our trials, the best results over the last three years for Dormex fell within a 49-54 **CP** range, <u>when calculated from onset of the Dynamic Model</u>, and the best CAN17 results from the last three years fell in a wider range of 49-60 **CP**. Within these effective ranges a greater or lesser success may be found and we continue to work to define these differences. We believe that using the Dynamic Model with **CP** continues to be the best way to calculate chill accumulation in California, with a change from the historic use of November 1 as the 'start date' for chilling to a date set by the Dynamic Model. This adjustment may help us to reduce the variation in response, safely time application of rest-breaking agents, and achieve good results.

Table 1. Chill portion (CP) accumulation evaluated for several years and sites in California.

1994-95 Hollister	CP	Date of first CP	1995-1996 Hollister	CP	Date of first CP	1996-97 Hollister	CP	Date of first CP
1 Nov	2	21 Oct	1 Nov	2	8 Oct	1 Nov	8	25 Sept
1 Dec	21		1 Dec	8		1 Dec	19	
1 Jan	43		1 Jan	25		1 Jan	35	
1 Feb	59		1 Feb	45		1 Feb	53	
1 Mar	73		1 Mar	54		1 Mar	71	
31 Mar	88		31 Mar	67		31 Mar	82	
1997-98 Morgan Hill	CP	Date of first CP	2003-04 Kettleman	CP	Date of first CP	2004-05 Kettleman	CP	Date of first CP
1 Nov	3	10 Oct	1 Nov	2	31 Oct	1 Nov	4	26 Oct
1 Dec	14		1 Dec	16		1 Dec	21	
1 Jan	36		1 Jan	35		1 Jan	43	
1 Feb	54		1 Feb	58		1 Feb	65	
1 Mar	73		1 Mar	75		1 Mar	80	
31 Mar	88		31 Mar	78		31 Mar	86	
2002-03 Lodi West	CP	Date of first CP	2003-04 Lodi West	CP	Date of first CP	2004-05 Lodi West	CP	Date of first CP
1 Nov	5	18 Oct	1 Nov	2	31 Oct	1 Nov	6	20 Oct
1 Dec	20		1 Dec	20		1 Dec	24	
1 Jan	42		1 Jan	42		1 Jan	45	
1 Feb	62		1 Feb	65		1 Feb	70	
1 Mar	79		1 Mar	84		1 Mar	85	
31 Mar	91		31 Mar	89		31 Mar	94	
Linden 1998-1999	CP	Date of first CP	Winters 1999-2000	CP	Date of first CP	Linden 2000-2001	CP	Date of first CP
1 Nov	3	25 Oct	1 Nov	0	9 Nov	1 Nov	6	11 Oct
1 Dec	21		1 Dec	12		1 Dec	27	
1 Jan	45		1 Jan	29		1 Jan	50	
1 Feb	66		1 Feb	51		1 Feb	73	
1 Mar	83		1 Mar	71		1 Mar	92	
31 Mar	100		31 Mar	80		31 Mar	99	